Human Health Implications of Arctic Environmental Contaminants

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OUTLINE

1. **Why the Concern?**

2. **Tissue Levels of Contaminants**
   - **Arctic Canada, Circumpolar**

3. **Contaminant Effects**

4. **Traditional and Market Foods**
   - **Risks and Benefits – community perspectives**

5. **National / International Actions**

Collaborators / Contributors

- Health Canada
- Indian and Northern Affairs Canada
- Centre for Indigenous Peoples Nutrition and Environment
- Territorial/Regional Health Departments
- Aboriginal organizations – ITK, Dene Nation, others
- Arctic Monitoring and Assessment Program
- Mothers and families

Why the Concern with Contaminants in the Arctic?

- Contaminants of Concern:
  - Mercury (Hg)
  - Persistent Organic Pollutants (POPs)
- Many contaminants were never manufactured or used in Arctic regions
- Contaminant levels in these people can be 10-20 times higher than in most temperate regions
- Northern Aboriginal people who rely on traditional diets are likely to be more exposed to several toxic substances than the majority of people elsewhere in the world

Northern Contaminants Program

aims to reduce and, wherever possible, eliminate contaminants in traditionally harvested foods, while providing information that assists individuals and communities to make informed decisions about their food use

Focus defined by blueprints:

- Abiotic monitoring
- Biotic monitoring
- Human Health
- Education and Communication
- Support for International Agreements

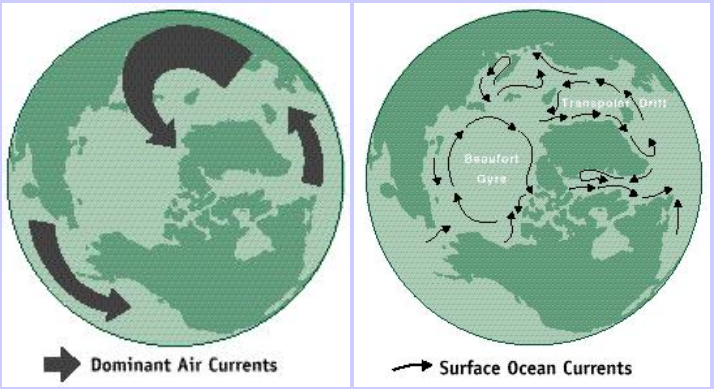
Working in partnership:

- INAC leadership
- Aboriginal Partners
- Federal departments
- Territorial & regional governments
- Universities & other research institutes, e.g. CINE

Critical Outcomes and Successes of NCP

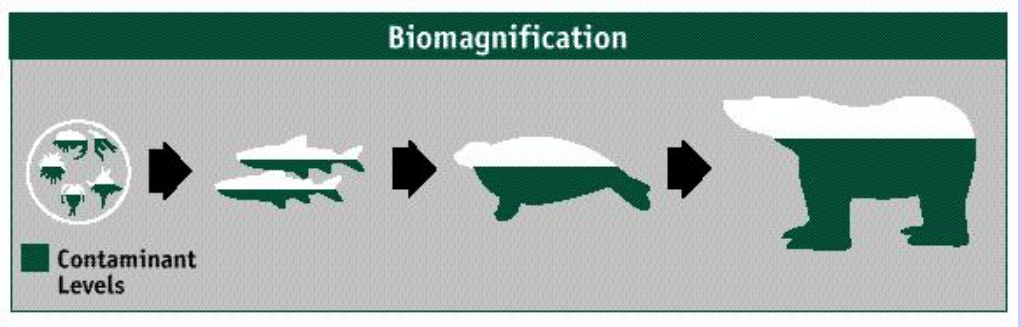
A. National

- Spatial and Temporal trends



- Identification of critical pathways/processes of delivery to Arctic ecosystems

- Characterization of contaminant profiles in terrestrial, aquatic and marine food webs



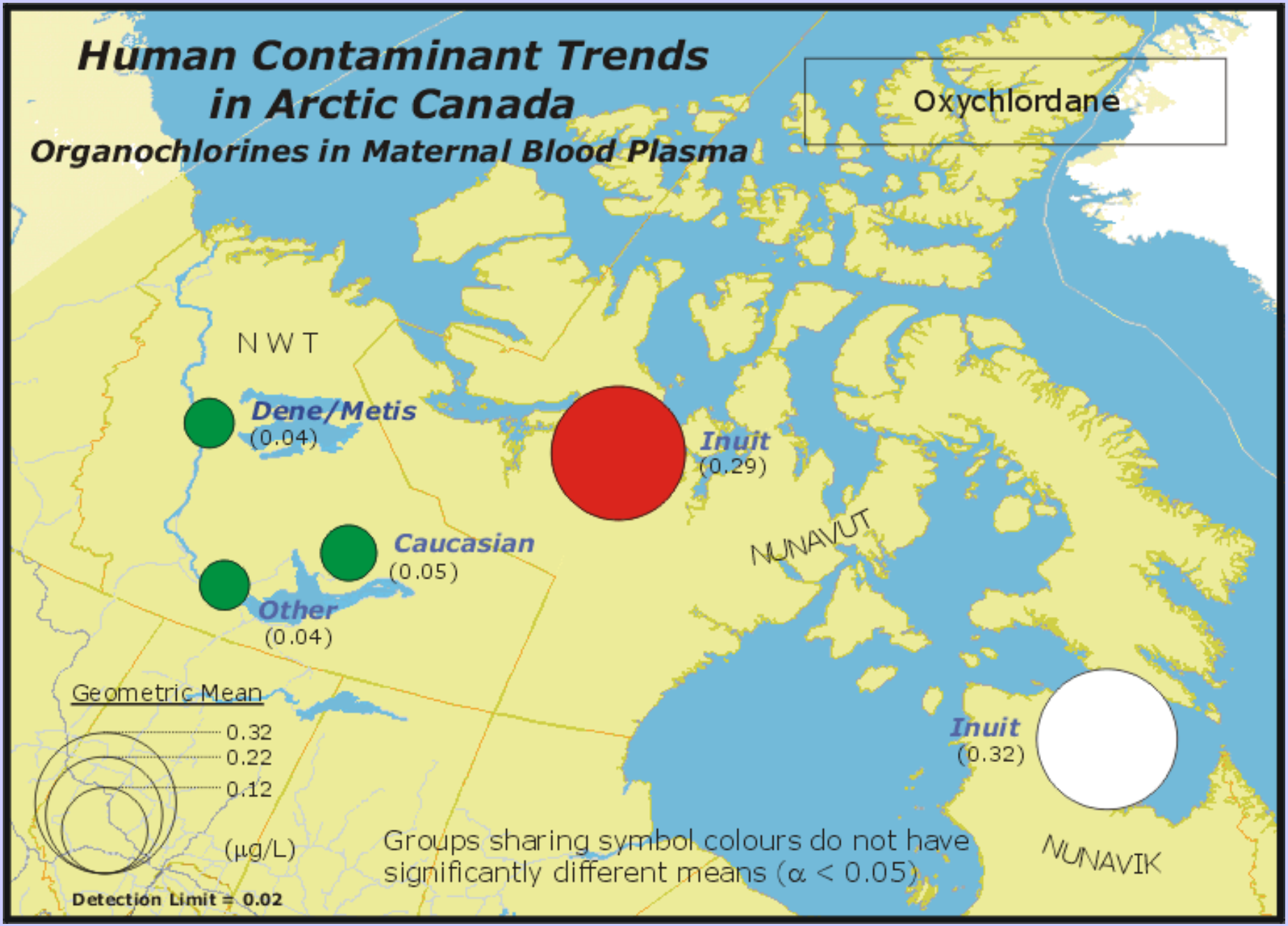
CONTAMINANTS IN MATERNAL BLOOD

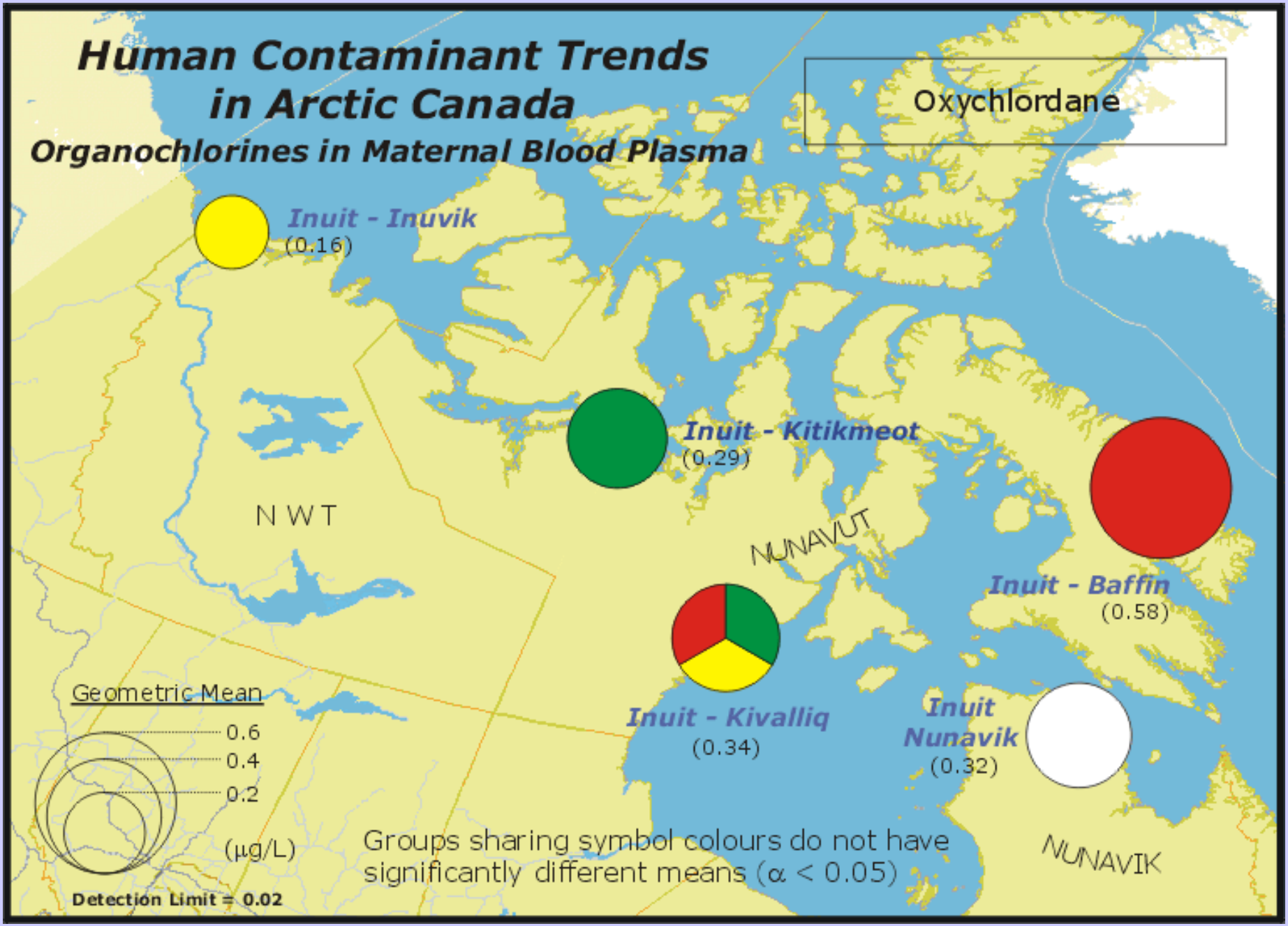
Jay Van Oostdam
Health Canada

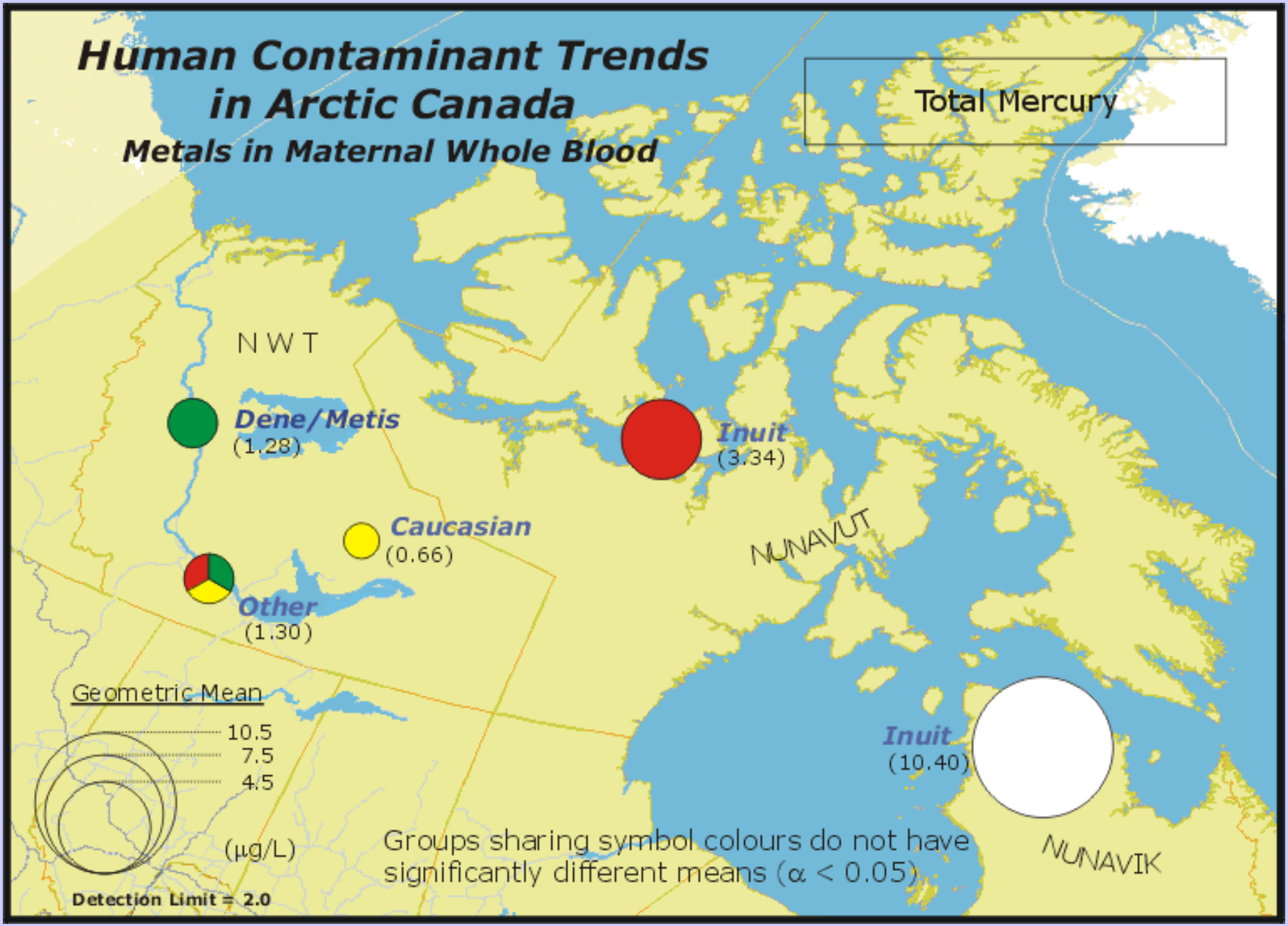
Contaminants Evaluated

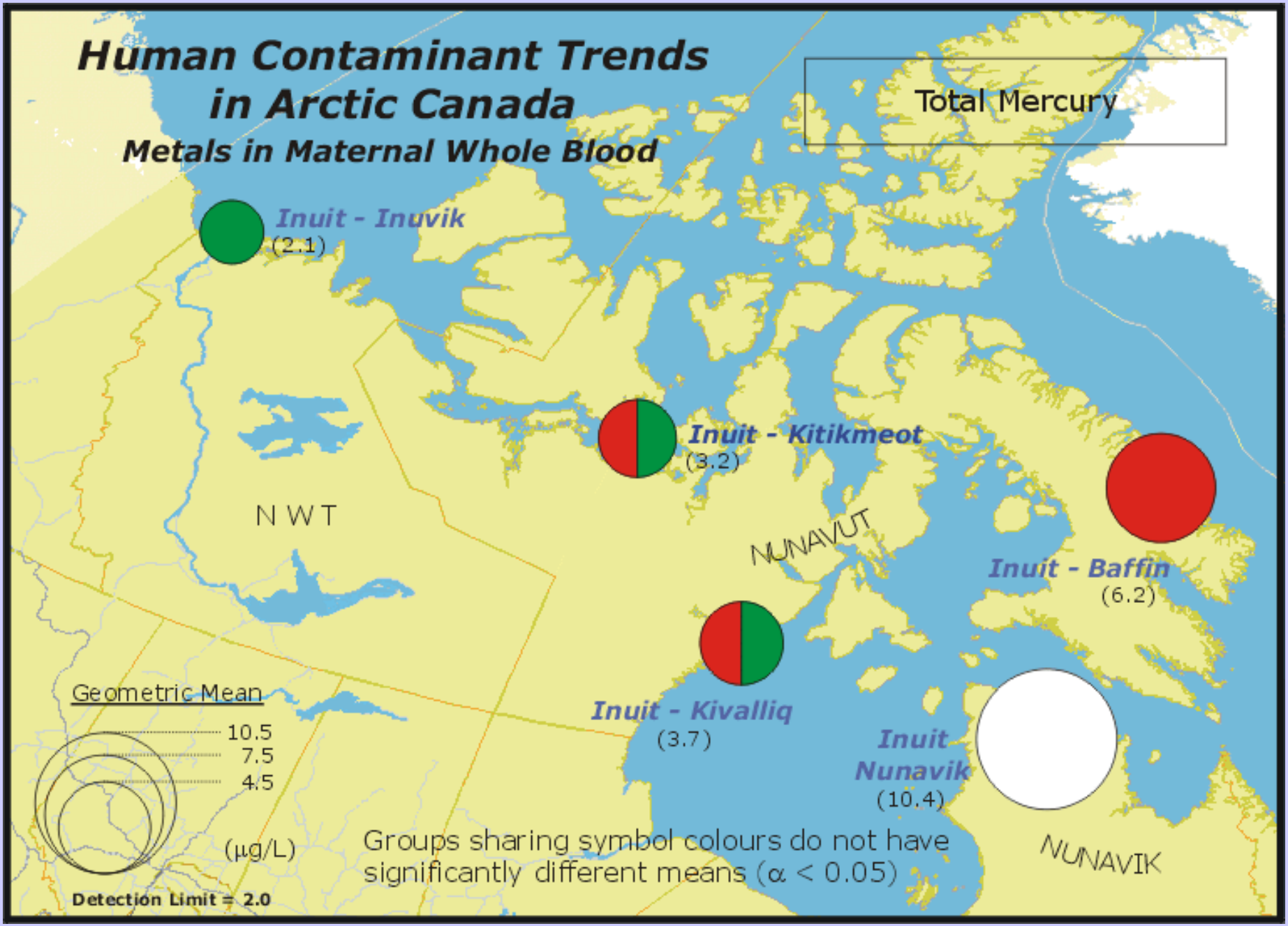
- Mercury
- Cadmium
- Lead

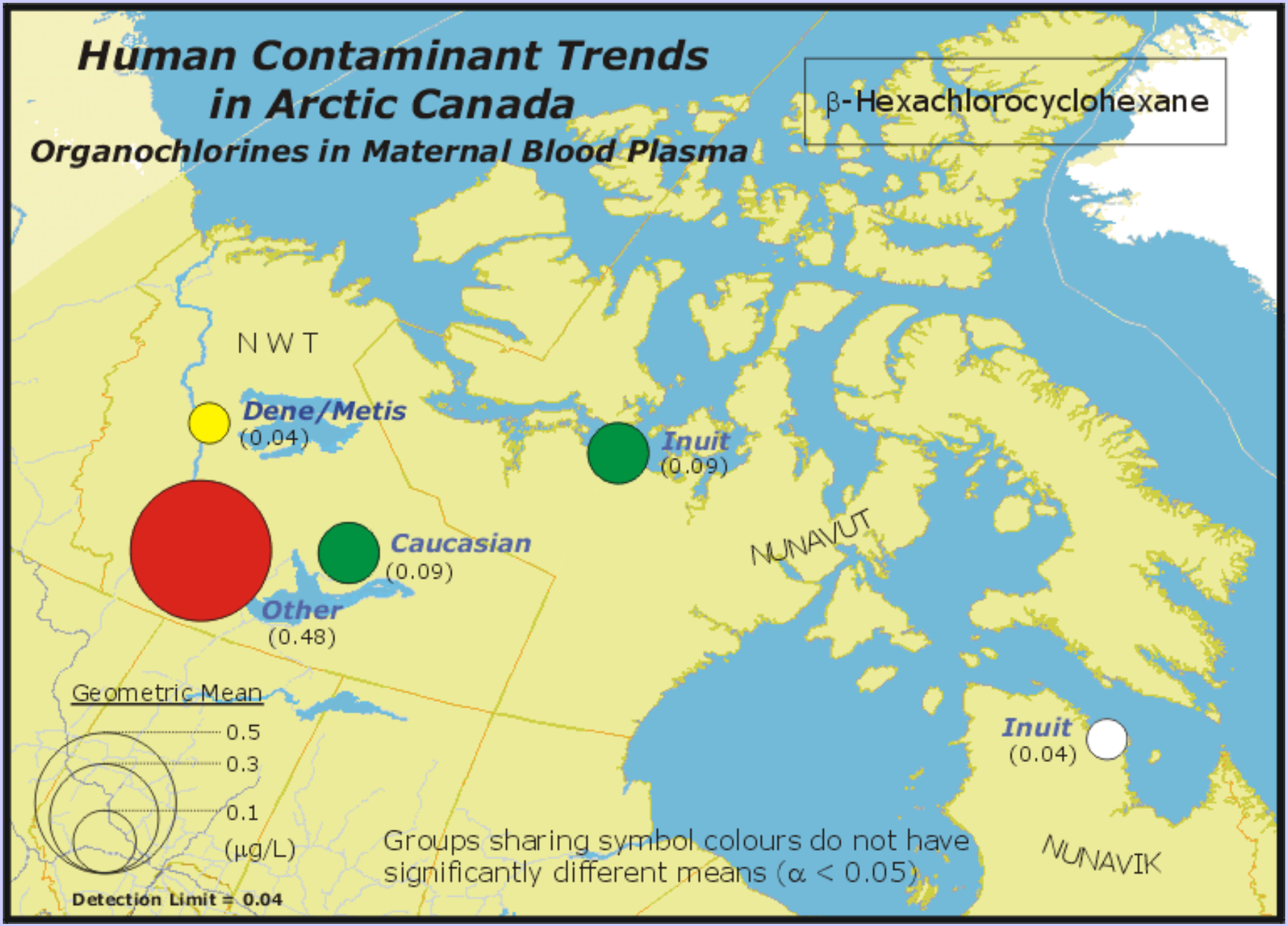
- PCBs
- DDT/DDE
- Chlordane
- Dieldrin
- Hexachlorobenzene
- Hexachlorcylohexane (𝛼,☎HCH)
- Toxaphene


Human Contaminant Trends
in Arctic Canada
Organochlorines in Maternal Blood Plasma
Oxychlordane
NWT
Dene/Metis
(0.04)
Inuit
(0.29)
NUNAVUT
Caucasian
(0.05)
Other
(0.04)
Geometric Mean
0.32
0.22
0.12
(µg/L)
Detection Limit = 0.02
Inuit
(0.32)
NUNAVIK
Groups sharing symbol colours do not have
significantly different means (α < 0.05)


Human Contaminant Trends
in Arctic Canada
Organochlorines in Maternal Blood Plasma
Oxychlordane
Inuit - Inuvik
(0.16)
Inuit - Kitikmeot
(0.29)
Inuit - Baffin
(0.58)
Inuit - Kivalliq
(0.34)
Inuit
Nunavik
(0.32)
N W T
NUNAVUT
NUNAVIK
Geometric Mean
0.6
0.4
0.2
(µg/L)
Detection Limit = 0.02
Groups sharing symbol colours do not have
significantly different means (α < 0.05)


Human Contaminant Trends
in Arctic Canada
Metals in Maternal Whole Blood
Total Mercury
N W T
Dene/Metis
(1.28)
Inuit
(3.34)
Caucasian
(0.66)
Other
(1.30)
NUNAVUT
Inuit
(10.40)
NUNAVIK
Geometric Mean
10.5
7.5
4.5
(µg/L)
Detection Limit = 2.0
Groups sharing symbol colours do not have
significantly different means (α < 0.05)

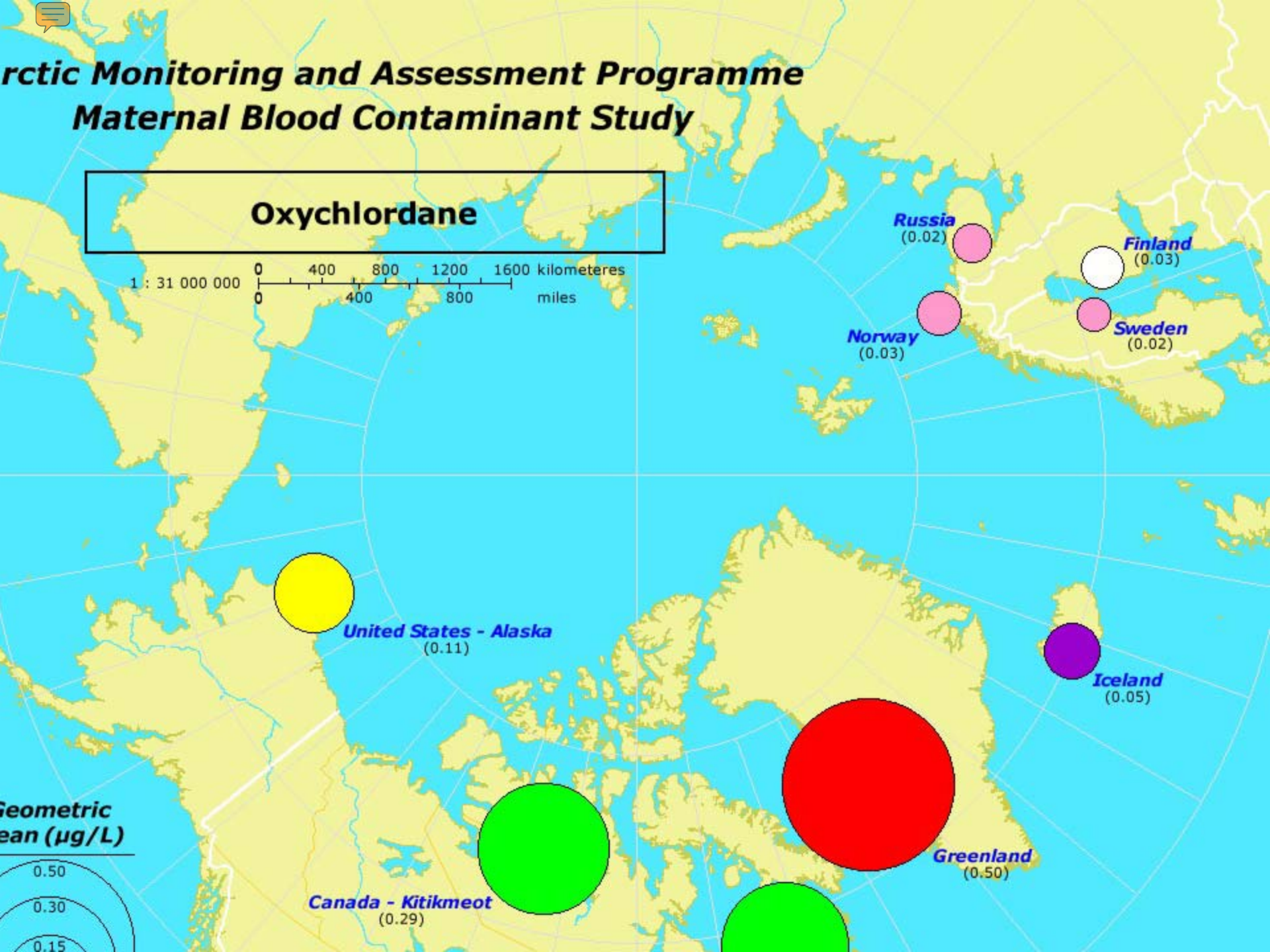

Human Contaminant Trends
in Arctic Canada
Metals in Maternal Whole Blood
Total Mercury
Inuit - Inuvik
(2.1)
Inuit - Kitikmeot
(3.2)
Inuit - Baffin
(6.2)
Inuit - Kivalliq
(3.7)
Inuit
Nunavik
(10.4)
N W T
NUNAVUT
NUNAVIK
Geometric Mean
10.5
7.5
4.5
(µg/L)
Detection Limit = 2.0
Groups sharing symbol colours do not have
significantly different means (α < 0.05)


Human Contaminant Trends
in Arctic Canada
Organochlorines in Maternal Blood Plasma
β-Hexachlorocyclohexane
N W T
Dene/Metis
(0.04)
Inuit
(0.09)
Caucasian
(0.09)
Other
(0.48)
NUNAVUT
Inuit
(0.04)
NUNAVIK
Geometric Mean
0.5
0.3
0.1
(µg/L)
Groups sharing symbol colours do not have
significantly different means (α < 0.05)
Detection Limit = 0.04

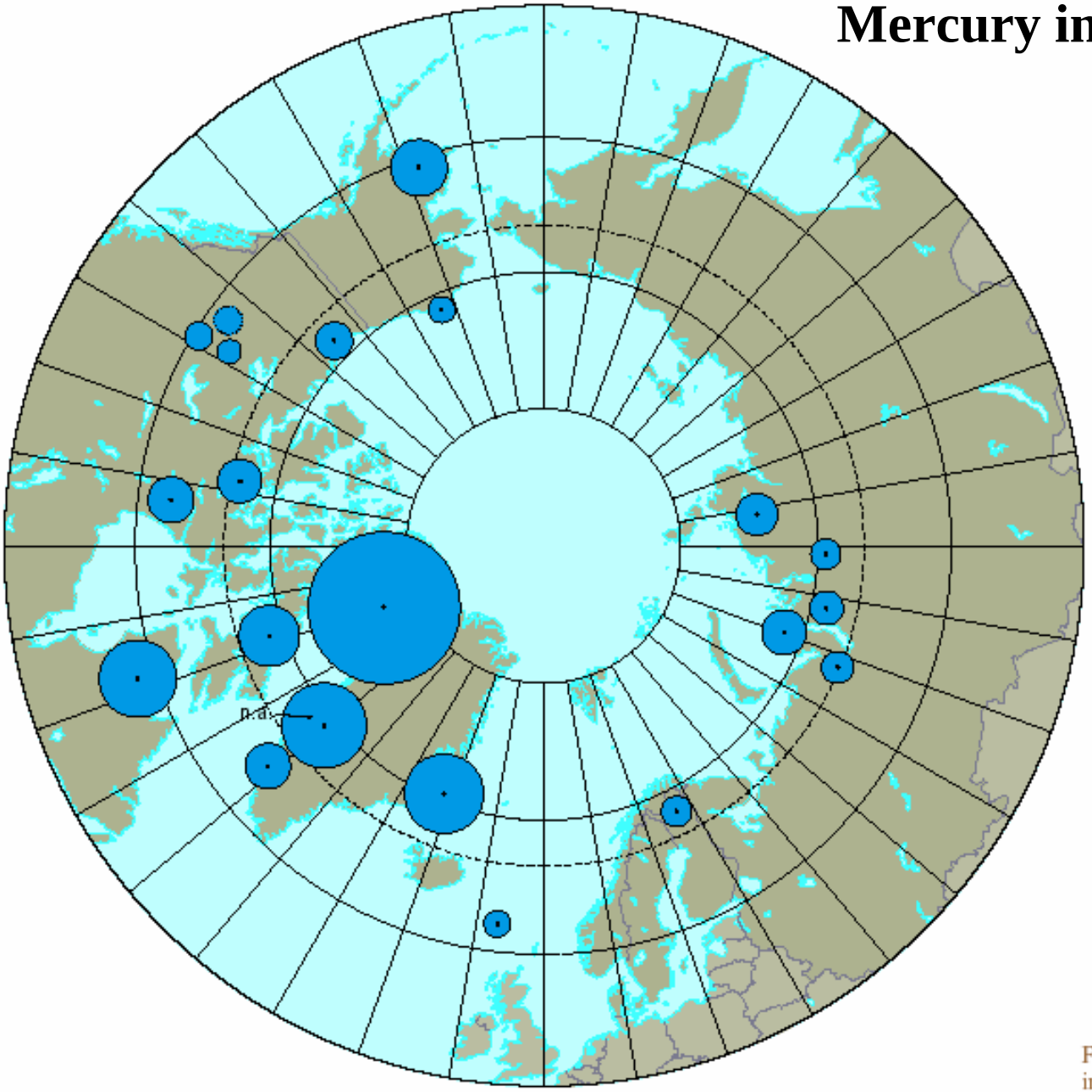
Arctic Monitoring and Assessment Program
Maternal Blood Contaminant Study

J.C. Van Oostdam [1,9], E. Dewailly[1], A. Gilman[1], J.C.Hansen[2], J.P. Weber [1], J.O. Odland [3], V. T Chaschin [4], J.Berner [5], J. Walker [1], B.J. Lagerkvist [6], K. Olafsdottir[7], L.Soininen [8], P. Bjerregard [2], V. Klopov [4]

[1] Canada, [2] Denmark, [3] Norway, [4] Russia, [5] United States, [6] Sweden, [7] Iceland, [8] Finland,


rctic Monitoring and Assessment Programme
Maternal Blood Contaminant Study
Oxychlordane
1 : 31 000 000
0 400 800 1200 1600 kilometeres
0 400 800 miles
Russia
(0.02)
Finland
(0.03)
Norway
(0.03)
Sweden
(0.02)
United States - Alaska
(0.11)
Iceland
(0.05)
Greenland
(0.50)
Canada - Kitikmeot
(0.29)
Geometric
ean (µg/L)
0.50
0.30
0.15

Mercury in Maternal Blood



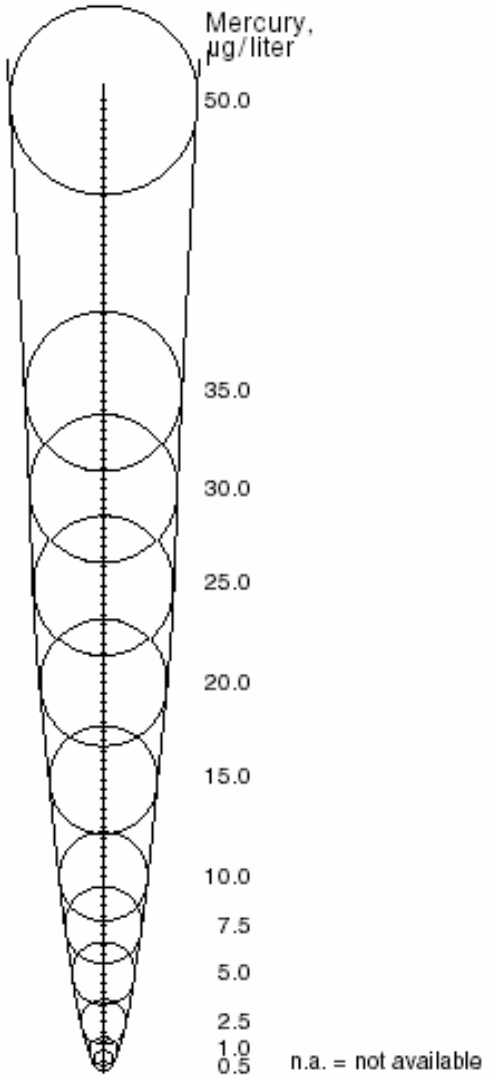


Figure H05£07. Mercury concentrations in maternal blood.

Arctic Monitoring and Assessment Programme
Maternal Blood Contaminant Study

Worldwide Comparisons

	NWT-Inuit	NWT-Other	Russia (non-indigenous)	India
β-HCH (μg/L)	0.09	0.48	1.6	127

Contaminant Effects

- **No Acute – High Dose Effects**
- **Effects at Lower Exposure levels**
  - **Subtle**
  - **Difficult to detect**

Contaminant Effects

Ongoing Research

- **Nunavik, Greenland, Faroe Islands**

Multisystemic

- **Immune – resistance to disease**
  - **Otitis media - PCBs, DDE – Nunavik**
  - **Biomarkers – cytokines, etc.**

Contaminant Effects

- **Neurodevelopmental**
  - **PCBs – reflexes, intellectual function**
  - **Mercury – motor function, visual memory**
- **Hormonal disruption**
  - **Sexual development – DDT, DDE, dioxin-like compounds – animal studies,**

Contaminant Effects

- **Ongoing epidemiological research**
  - **Research to date – subtle effects**
    – concern to northerners / researchers
  - **Arctic research - upcoming**

Figure 4. Balancing dietary benefits and risks

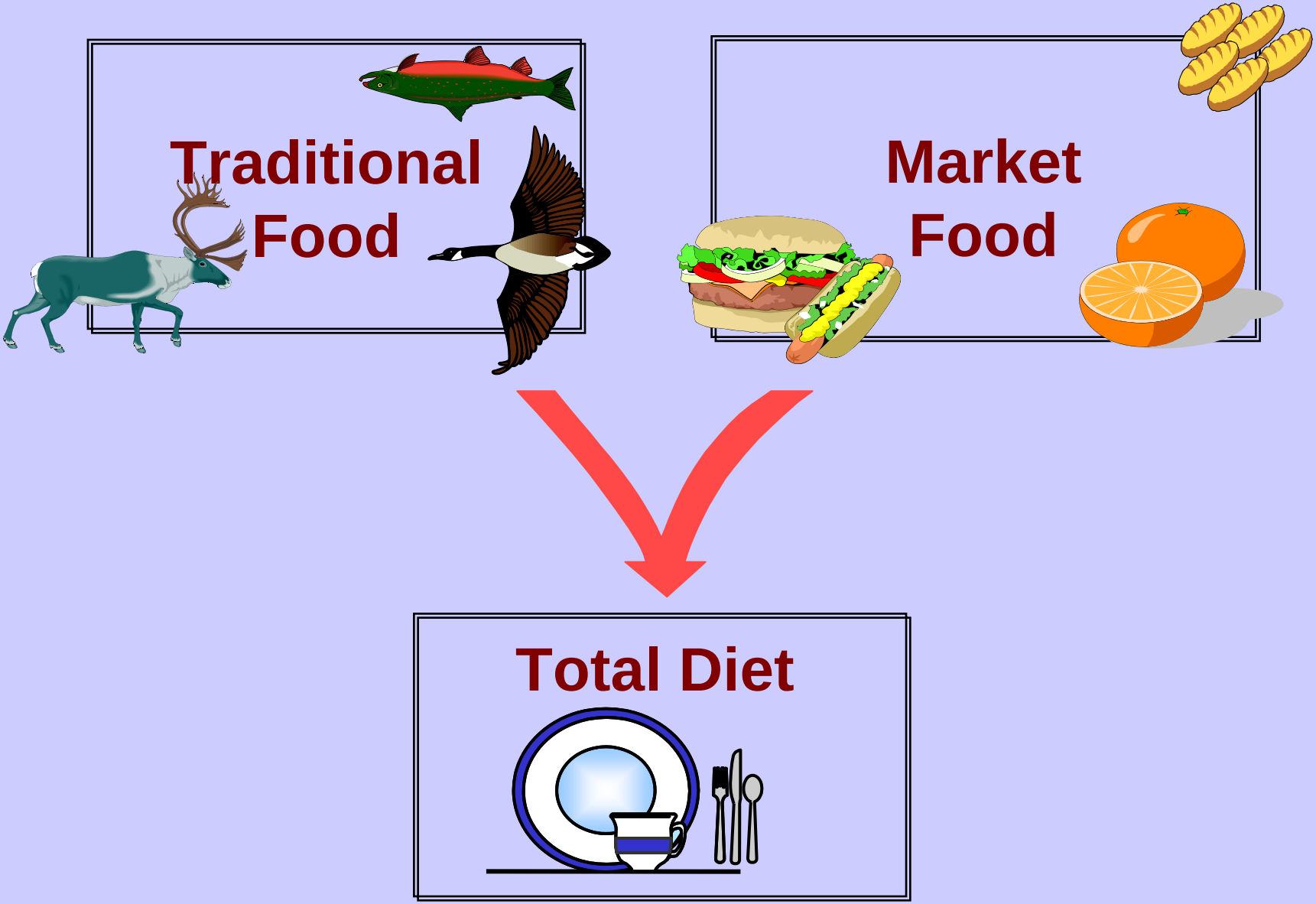


Figure 2a. Mean Intake of Chlordane, Toxaphene and Mercury in Northern Canada (µg/kg/d)

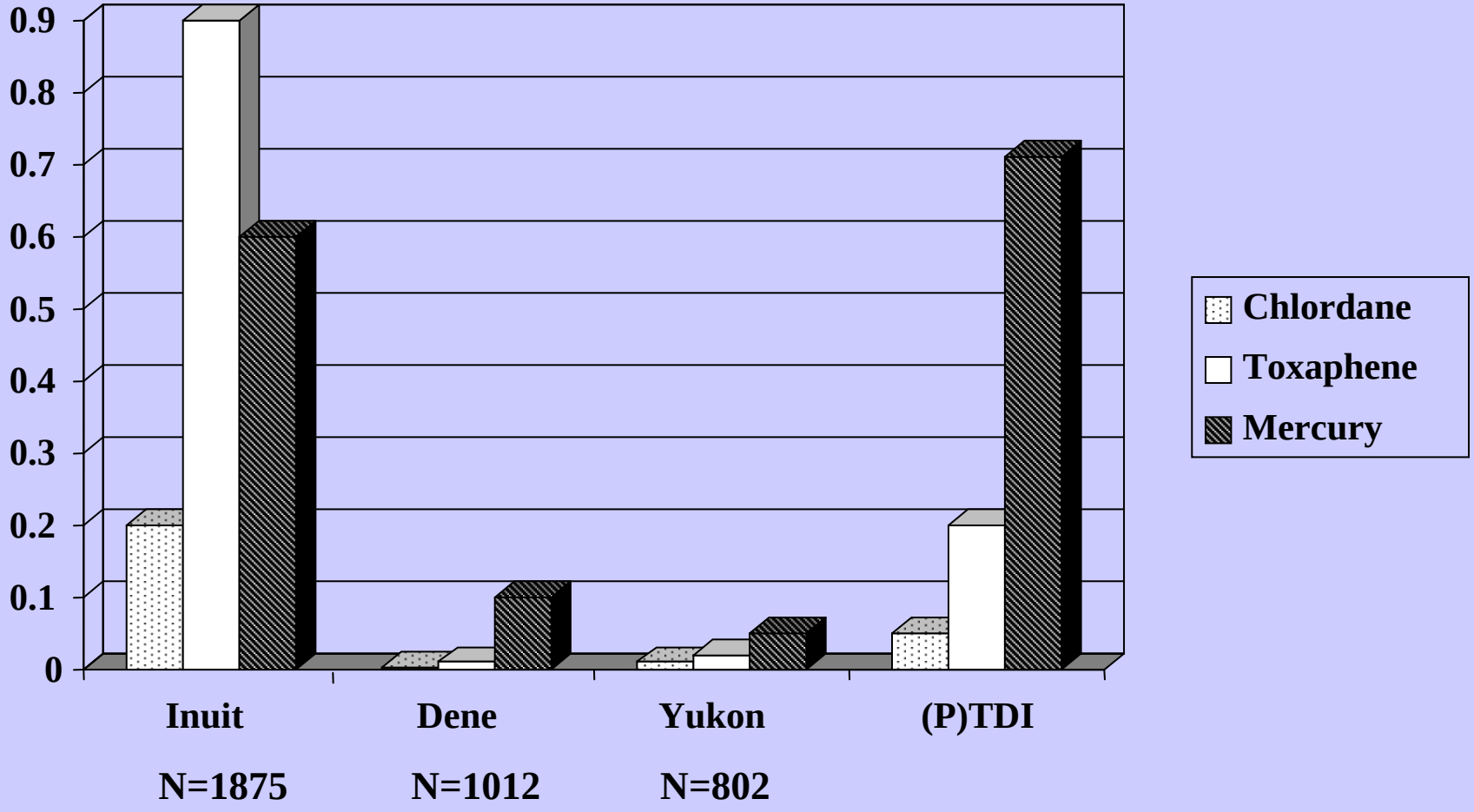


Table 8. Sources of organochlorines in the Baffin region (contribution %)

Species	Part	weight	CHL	PCB	TOX
CARIBOU	FLESH	38.2	0.9	1.3	0.1
RINGED SEAL	FLESH	18.7	0.8	2.4	8.9
ARCTIC CHAR	FLESH	15.6	2.2	1.5	3
NARWHAL	MUKTUK	5	1.8	7	0.1
WALRUS	FLESH	3.2	1.7	0.6	0.1
RINGED SEAL	BROTH	2.9	0.2	1.1	0.1
POLAR BEAR	FLESH	2.8	1.5	3.1	0.1
NARWHAL	BLUBBER	1.9	37.9	44.5	35.6
PTARMIGAN	FLESH	1.3	0	0	0
BELUGA	MUKTUK	1.2	1.7	1.7	0.9
WALRUS	BLUBBER	1.2	34.9	22.2	43.1
BELUGA	BLUBBER	0.4	11.1	8.5	6.3
RINGED SEAL	BLUBBER	0.3	1.9	1.3	0.3
POLAR BEAR	FAT	0.1	2.3	1.6	0.5
	Total (%)	92.8	98.9	96.8	99.1

Community Perspectives

- Donaldson, Van Oostdam, Doubleday
  - Community based research
  - Dietary decision making
    - Availability
    - Preferences
    - Contaminants - ?

Community Perspectives

Culture - sharing

- My culture teaches us to share with anyone who needs it. For example, a hunter will go over the community radio to let community members know that he has country food to give away. This is important for us. Sharing country food helps the community out. I think sharing is a value that makes Inuit different from those living outside of Nunavut.

Elder (M, 55-64)

Community Perspectives

Nutrition

- I always feel better after eating country food compared to food from the store. It makes you feel stronger and you have more energy. If you have store food you get tired soon after you eat and you get hungry again. When you eat country food it makes you feel strong and you do not get hungry again.

Young Inuit Artist (male, 20-24)

Community Perspectives

Economic

Sometimes when my wife and I do not have much money we will get country food from a hunter. This saves us money and gets us through the hard times.

Inuk (male, 40-45)

Community Perspectives
Fitness

The other day, I went out on the land. I shot a caribou about 5 miles from my boat. Getting the caribou to the boat was a lot of physical work for me. I had to drag and carry the caribou most of the way. When I got back to the boat, I was tired, but it felt good to get the exercise.

Hunter (male, 45-50)

Community Perspectives
Mental health

- The land is invigorating and refreshing. It rejuvenates the body and cleanses the mind. If I had a choice I would be living on the land in a cabin. I become stir crazy when I stay in the city for too long. After being out on the land I get a nice tired feeling. I no longer feel stressed. Inuk (female, 30-35)

Traditional Knowledge – Elders - Youth

Communication on Contaminants

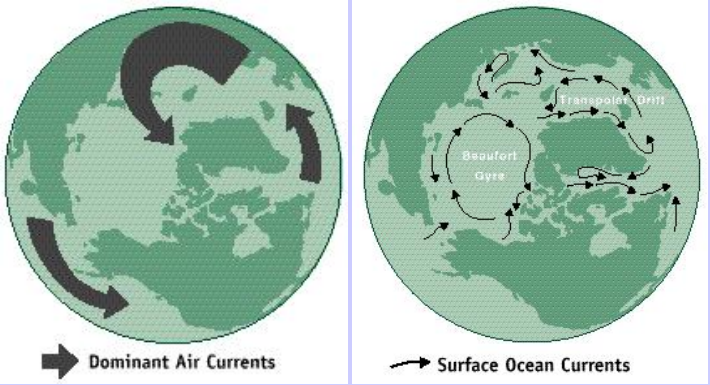
- Led by Territorial / Provincial /regional health agencies
- Aboriginal partners, communities
- Advice from Health Canada

COUNTRY FOOD IS GOOD FOR YOU AND YOUR FAMILY

Critical Outcomes and Successes of NCP

A. National

- Spatial and Temporal trends



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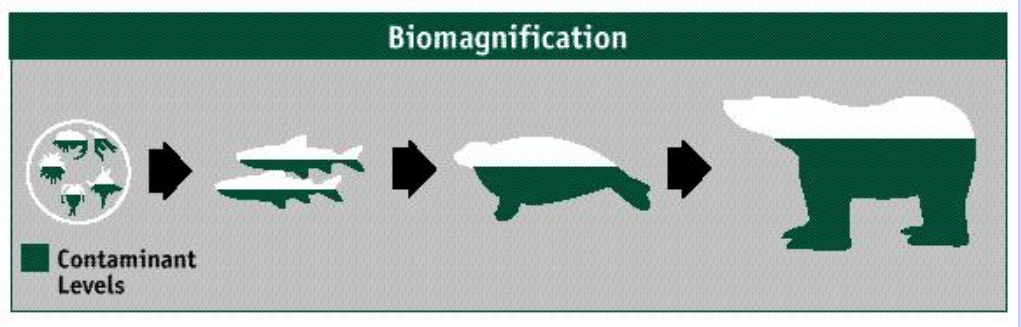

International Action

UN-ECE LRTAP Convention

- **1998 Protocols signed by 36 northern hemisphere countries**
  - Severely bans/restricts the manufacture, use or loss to the environment of 16 POP substances and sets controls for 3 metals

UNEP Global Agreement on POPs

- **2001 Stockholm Convention signed by 151 countries**
  - Severely bans/restricts the manufacture, use or loss to the environment of 12 substances
  - Canada was the first to ratify in May 2001

Aboriginal Cooperation on the POPs Issue

Canadian Arctic Indigenous Peoples Against POPs (CAIPAP) + Russian Arctic Indigenous Peoples (RAIPON) + Saami Council

Ensured that international agreements on POPs protect

Arctic Aboriginal people


Thank you